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Performance-Based Contracts for Outpatient Medical Services

Abstract

In recent years, the performance-based approach to contracting for medical services has been gaining popularity across different healthcare delivery systems, both in the United States (under the name of “pay for performance”) and abroad (“payment by results” in the United Kingdom). The goal of our research is to build a unified performance-based contracting (PBC) framework that incorporates patient access-to-care requirements and that explicitly accounts for the complex outpatient care dynamics facilitated by the use of an online appointment scheduling system. We address the optimal contracting problem in a principal–agent framework where a service purchaser (the principal) minimizes her cost of purchasing the services and achieves the performance target (a waiting-time target) while taking into account the response of the provider (the agent) to the contract terms. Given the incentives offered by the contract, the provider maximizes his payoff by allocating his outpatient service capacity among three patient groups: urgent patients, dedicated advance patients, and flexible advance patients. We model the appointment dynamics as that of an $M/D/1$ queue and analyze several contracting approaches under adverse selection (asymmetric information) and moral hazard (private actions) settings. Our results show that simple and popular schemes used in practice cannot implement the first-best solution and that the linear performance-based contract cannot implement the second-best solution. To overcome these limitations, we propose a threshold-penalty PBC approach and show that it coordinates the system for an arbitrary patient mix and that it achieves the second-best performance for the setting where all advance patients are dedicated.

Keywords

healthcare, performance-based contracting, principal–agent theory, queueing theory

Disciplines

Business | Finance and Financial Management

Performance-Based Contracts for Outpatient Medical Services

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Since 2002, the UK National Health Service (NHS) has used a system of hospital financing called Payment-by-Results (PbR) ². Under PbR, a service provider (a hospital) receives a fixed payment from a service purchaser (a government agency) for each treatment, based on treatment's Health Resource Group (HRG) code (the UK analog of the US DRG code). PbR payment scheme, while providing incentives to reduce operational costs, does not deal with the issues of service quality, including that of patient access to care. More recently, as a part of a separate program, NHS has introduced a series of patient waiting time targets including the 18-week period as a maximum waiting time for any outpatient to receive their first treatment, once the need for this treatment is identified ³. Our research studies the interaction between the PbR approach and the operational performance constraints by incorporating both into a unified performance-based contracting (PBC) framework.

The extant literature includes the studies of PBC in the context of resource allocation decisions and the analysis of commonly observed contracts (Kim et al. (2007)), and coordination of service capacity decisions in call center settings (Hasija et al. (2004)). Lu and Donaldson (2000) review economic theories of contracting and provide an additional motivation for the potential use of PBC for improving the efficiency of healthcare delivery systems. Siciliani (2007) presents a model of optimal contracting activities and waiting time for health services in the presence of excess demand and waiting times with asymmetric information of demand. A separating equilibrium exists when it is optimal for the purchaser to contract more activities and longer waiting times to those hospitals with higher demand. Hospitals with low demand gain informational rents. Lee and Zenios (2007) develop an empirical method to estimate the parameters of a multi-task principal-agent model arising from a healthcare application. In our work, we follow health economics literature by applying the principal-agent theory for the study of contract design in the context of outpatient medical services. However, unlike health economics literature where agent's problems are relatively simple, often deterministic, and, normally, involve a one-dimensional response, agent's problem in our model is more complex, reflecting important features of real-life allocation of service capacity in outpatient environments.

In our model of outpatient care, we use the Choose-and-Book (CaB) setting adopted in the UK, under which patients schedule advance appointments using a national online booking system. A hospital, based on the private information about its operational costs, makes two types of capacity allocation decisions: how many appointment slots to make available through the CaB system (and,

² <http://www.dh.gov.uk/en/Managingyourorganisation/Financeandplanning/NHSFinancialReforms/index.htm>

³ <http://www.18weeks.nhs.uk>

consequently, how many to reserve for same-day urgent cases), and how many days in advance should such capacity be released. Using these decision levers, hospital allocates its service capacity between same-day patients as well as two distinct types of patients with delayed service requests, “committed” and “undecided”. Committed patients insist on having their service provided by a particular hospital, irrespective of whether the CaB system shows any appointments available in that hospital - and the recourse they have is to enforce an appointment within the 18-week horizon through the use of a phone-based override system. Undecided patients, on the other hand, will select another service provider and forgo the additional inconvenience associated with using the override if the CaB system shows no available appointments within the horizon chosen by their first-choice provider. We assume that the hospital receives from the government agency a known revenue (similar to payment specified through PbR contracts) for each patient receiving care. In addition, the hospital incurs penalties if its operational planning turns out to be inadequate. First, the overtime penalty is incurred in cases when the total daily demand for outpatient services exceeds hospital’s nominal service capacity (the value of the overtime cost is assumed to be hospital’s private information). Also, every time a patient switches to another hospital due to lack of appointment capacity declared through the CaB system, a “work transfer” penalty is incurred. Finally, government agency charges hospital a “performance” penalty proportional to the length of the appointment waiting list it has. The revenue amount and the performance penalty value form the core of hospital’s PBC contract put forward by the government agency. In our analysis, we consider an asymmetric information setting, in which a hospital has a perfect knowledge about the value of its overtime cost, while the government only knows the distribution of its potential values. In this setting, the government agency makes its decision regarding the parameters of the PBC contract in anticipation of provider’s rational choices with respect the proportion of the total daily capacity allocated to advance appointments and the threshold on the queue of advance appointments.

Such contract can be modeled using the principal-agent framework in which the purchaser of services acts as a principal and the service provider is an agent. The agent aims to maximize his profit which consists of the payment for provided services net of the penalty for making patients waiting and the overtime and the work-transfer cost. The principal wants to minimize her cost (payments made to the provider off-set by the waiting time penalty of achieving the expected waiting time target of 18 weeks). In addition, principal’s problem includes the standard individual rationality constraint inducing the agent to accept the contract, as well as the incentive compatibility constraint forcing the agent to reveal the true value of his overtime cost. Under the principal-agent

framework, we analyze both PbR and PBC approaches under the adverse selection (asymmetric information) and moral hazard (private actions) settings. For both settings, we study the first-best and the second-best solutions, as well as the performance of a simple contract which applies the same contract parameters to all agents, irrespective of their overtime cost values. In particular, our analysis addresses the following questions:

- What is the optimal structure for each type of contract under different information settings?
- When does PBC approach result in better outcomes for the principal, and,
- What is the impact of the waiting time target on agent's decisions and principal's optimal contract design?

In our analysis, we gain important insights by comparing PbR and PBC under different information structures: complete information, asymmetric information, and private actions. In particular, we show that when the agent's capacity allocation decisions are observable and contractible, PbR and PBC approaches produce the same outcomes, irrespective of whether the information setting is symmetric or asymmetric. However, if agent's decisions are not observable and contractible, PBC outperforms PbR. This suggests that performance-related incentives should be incorporated into service procurement contracts. In fact, the Department of Health recently introduced financial adjustments, which are related to the 18-week waiting time target, into the existing standard contract framework. This practical enhancement is supported our theoretical finding.

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